WHAT IS CLAIMED IS:

1. A quantum switch comprising:

a medium containing at least a first elementary particle;

a control input for receiving at least a second elementary particle and causing said second elementary particle to interact with said first elementary particle, thereby changing a state of at least one of said elementary particles; and

an output for conveying a state change of at least one of said first and second elementary particles.

2. The quantum switch of claim 1, wherein said first elementary particle is an electron and said second elementary particle is a first photon.

3. The quantum switch of claim 2, wherein said change of state comprises a change of state of said electron.

4. The quantum switch of claim 3, wherein said change of state of said electron causes emission of at least a second photon on said output.

5. The quantum switch of claim 4, wherein said first photon is a UV photon that is incident on said medium at a controllable angle, and said change of state of said electron causes emission of first and second IR photons on said output, said IR photons having polarizations that are either the same as one another or different from one another, depending on the angle of

incidence of said UV photon, whereby, the angle of incidence of said UV photon can be used to control the output value of said switch.

6. The quantum switch of claim 1, wherein said first elementary particle is an electron and said at least a second elementary particle comprise first and second IR photons.

7. The quantum switch of claim 6, wherein said change of state comprises a change of state of said electron.

8. The quantum switch of claim 7, wherein said change of state of said electron causes emission of a UV photon on said output.

9. The quantum switch of claim 1, wherein said medium comprises a nonlinear crystal.

10. The quantum switch of claim 9, wherein said crystal is beta barium borate.

11. A switching circuit comprising:

a first quantum switch having a control input for receiving at least a first elementary particle, a medium containing at least a second elementary particle for interaction with said first elementary particle, and an output for conveying a state change of a least one of said first and second elementary particles resulting from said interaction; and

a second quantum switch having a control input connected to said output of said first quantum switch for receiving at least a third elementary particle, a medium containing at least a fourth elementary particle for interaction with said third elementary particle, and an output for conveying a state change of a least one of said third and fourth elementary particles resulting from said interaction

12. The switching circuit of claim 11, wherein said first elementary particle comprises at least a first photon, said third elementary particle comprises at least a second photon, and said second and fourth elementary particles each comprise first and second electrons, respectively.

13. The switching circuit of claim 12, wherein said state change in each of said quantum switches comprises a change of state of said first and second electrons.

14. The switching circuit of claim 13, wherein said at least one photon in said first quantum switch is a first UV photon that is incident on said medium at a controllable angle, and said change of state of said electron causes emission of first and second IR photons on said output of said first quantum switch, said IR photons having polarizations that are either the same as one another or different from one another, depending on the angle of incidence of said first UV photon, whereby, the angle of incidence of said first UV photon is used to control the output value of said first quantum switch; and, said first and second IR photons also comprise said at least one photon in said second quantum switch; whereby, said first and second IR photons cause a change of state in said electron in said medium of said second quantum switch, thereby

generating a second UV photon as output from said second quantum switch, said second UV photon having a polarization that is dependent on the angle of incidence of said first UV photon on said medium of said first quantum switch.

15. The switching circuit of claim 14, further comprising a third quantum switch for receiving said first IR photon from said output of said first quantum switch and selectively changing the polarization of said first IR photon before supplying said first IR photon as input to said second quantum switch, whereby, said switching circuit comprises a logic gate with said control input of said first quantum switch and a control input of said third quantum switch serving as first and second inputs to said logic gate and said output of said second quantum switch serving as an output of said logic gate.

16. The switching circuit of claim 15, further comprising a fourth quantum switch for receiving said second IR photon from said output of said first quantum switch and reflecting said second IR photon without changing its polarization before supplying said second IR photon as input to said second quantum switch to insure that said first and second IR photons arrive at said input of said second quantum switch at the same time.

17. The switching circuit of claim 11, wherein said medium of said first and second quantum switches comprises a nonlinear crystal.

18. The switching circuit of claim 17, wherein said crystal is beta barium borate.

19. A method for providing a switching function comprising the steps of:

providing a first medium containing at least a first elementary particle;

causing a second elementary particle to interact with said first elementary particle as a switching input, thereby changing a state of at least one of said elementary particles; and

employing said state change of at least one of said first and second elementary particles as a switching output.

20. The method of claim 19, wherein said first elementary particle is selected to be an electron and said second elementary particle is selected to be at least a first photon.

21. The method of claim 20, wherein said change of state comprises a change of state of said electron and said change of state of said electron causes emission of at least a second photon as an output.

22. The method of claim 21, wherein said first photon is a UV photon and said step of causing said UV photon to interact with said electron comprises causing said UV photon to be incident on said medium at a selected angle, whereby said change of state of said electron causes emission of first and second IR photons as output, said IR photons having polarizations that are either the same as one another or different from one another, depending on the angle of incidence of said UV photon, whereby, the angle of incidence of said UV photon can be used to control a value of said switching output.

23. The method of claim 19, wherein said first elementary particle is selected to be an electron and said second elementary particle is selected to be first and second IR photons.

24. The method of claim 23, wherein said change of state comprises a change of state of said electron and said change of state of said electron causes emission of a UV photon on said output.

25. The method of claim 19, wherein said medium is selected to be a nonlinear crystal.

26. The method of claim 25, wherein said crystal is selected to be beta barium borate.

27. A method for operating a quantum switch-based switching circuit comprising the steps of:

providing a first quantum switch having a control input, an output and a medium containing at least a first elementary particle;

providing a second quantum switch having a control input, an output and a medium containing at least a second elementary particle, said first quantum switch output being connected to said control input of said second quantum switch;

receiving at least a third elementary particle on said control input of said first quantum switch and causing said third elementary particle to interact with said first elementary particle, thereby changing a state of at least one of said first or third elementary particles and generating at least a fifth elementary particle on said output of said first quantum switch;

receiving said at least fifth elementary particle on said control input of said second quantum switch and causing said fifth elementary particle to interact with said second elementary particle, thereby changing a state of at least one of said second or fifth elementary particles and generating at least a sixth elementary particle on said output of said second quantum switch; and

detecting a state of said sixth elementary particle to determine an output value of said first quantum switch.

28. The method of claim 27, wherein said first and second elementary particles are each selected to be first and second electrons, respectively, and said third, fifth and sixth elementary particles are each selected to be at least a first, second and third photon, respectively.

29. The method of claim 28, wherein said changes of state comprise a change of state of said first and second electrons, respectively.

30. The method of claim 29, wherein said at least a first photon in said first quantum switch is a first UV photon, and said step of causing said third elementary particle to interact with said first elementary particle comprises causing said at least first photon to be incident on said medium at a controllable angle, thereby change of state of said first electron and causing emission of first and second IR photons on said output of said first quantum switch, said IR photons having polarizations that are either the same as one another or different from one another, depending on the angle of incidence of said first UV photon, whereby, the angle of incidence of said first UV photon is used to control the output value of said first quantum switch;

and, said first and second IR photons also comprise said at least second photon that is received on said control input of said second quantum switch; whereby, said first and second IR photons cause a change of state in said second electron in said medium of said second quantum switch, thereby generating a second UV photon as output from said second quantum switch, said second UV photon having a polarization that is dependent on the angle of incidence of said first UV photon on said medium of said first quantum switch and can thus be used to determine an output value of said first quantum switch.

31. The method of claim 30, further comprising the steps of:

providing a third quantum switch having a control input, an output and a medium containing at least a seventh elementary particle;

receiving said first IR photon from said output of said first quantum switch on said control input of said third quantum switch; and

selectively changing the polarization of said first IR photon with said third quantum switch before supplying said first IR photon as input to said second quantum switch, whereby, said switching circuit comprises a logic gate with said control input of said first quantum switch and said control input of said third quantum switch serving as first and second inputs to said logic gate and said output of said second quantum switch serving as an output of said logic gate.

32. The method of claim 31, further comprising the steps of:

providing a fourth quantum switch having a control input, an output and a medium containing at least an eight elementary particle;

receiving said second IR photon from said output of said first quantum switch on said control input of said fourth quantum switch and reflecting said second IR photon without changing its polarization before supplying said second IR photon as input to said second quantum switch to insure that said first and second IR photons arrive at said input of said second quantum switch at the same time.

33. The method of claim 27, wherein said medium of said first and second quantum switches is selected to be a nonlinear crystal.

34. The method of claim 33, wherein said crystal is selected to be beta barium borate.